



State Of California

ALFRED E. ALQUIST
SEISMIC SAFETY COMMISSION

Arnold Schwarzenegger, Governor



CALIFORNIA/BAJA CALIFORNIA AGRICULTURAL SUMMIT:
IMPACTS ON AGRICULTURE AND LESSONS LEARNED
FROM THE EL MAYOR-CUCAPAH EARTHQUAKE

Minutes of Meeting

November 4, 2010

Leland Stanford Mansion and State Historic Park, 8th and N Streets, Sacramento, California

Participants

Robert Anderson, Engineering Geologist, Seismic Safety Commission
Devon Berrier, State and Consumer Services Agency
Matthew Bettenhausen, Secretary, California Emergency Management Agency
Charles Burt, California Polytechnic State University
Karen Cogan, Administrative Manager, Seismic Safety Commission
Eric Frost, San Diego State University
Carlos Gutierrez, Mexican Consulate
Ken Hudnut, U.S. Geological Survey
Brent Jamison, State and Consumer Services Agency
Dave King, Legislative Manager, Seismic Safety Commission
Helen Lopez, California Emergency Management Agency
Emir Macari, California State University at Sacramento
Elizabeth Mathieson, Commissioner, Seismic Safety Commission
Richard McCarthy, Executive Director, Seismic Safety Commission
Tim McCrink, California Geological Survey
Victor Peláez Millán, Mexican Consulate
David Pegos, California Department of Food and Agriculture
Francisco Javier Sarmiento Pérez, Agriculture, Baja, Mexico
Cindy Pridmore, California Geological Survey,
Carlos Ramón Orozco Riezgo, Agriculture, Baja, Mexico
John Rowden, California Department of Food and Agriculture
Heidi Stenner, Exponent
Fred Turner, Senior Structural Engineer, Seismic Safety Commission

I. INTRODUCTIONS AND WELCOME STATEMENTS

Mr. Richard McCarthy, Executive Director, California Seismic Safety Commission, welcomed everyone to the Leland Stanford Mansion and State Historic Park in Sacramento. Mr. McCarthy suggested starting with brief introductions, and participants took turns introducing themselves.

Mr. McCarthy explained that the purpose of this agricultural summit meeting was to discuss impacts of the April 4, 2010 El Mayor-Cucapah earthquake on Mexican agriculture and apply lessons learned to California. He noted that the earthquake did significant damage to Mexico's cultivated crops, and Mexico can become a leader in advancing knowledge of earthquakes' potential agricultural impacts. He advised that the summit would begin with presentations from officials from Baja, Mexico, followed by remarks from representatives of California agencies, and then general discussion.

II. BAJA AGRICULTURAL DAMAGE PRESENTATIONS

Señor Francisco Javier Sarmiento Pérez showed slides of the area affected by the April 4, 2010 earthquake, pointed out its epicenter, and indicated specific areas subject to strong shaking and damage. He stated that the earthquake was a 7.2 magnitude event that lasted 89 seconds and was felt as far away as Ensenada. The earthquake caused major damage to irrigation canals, land, and crops. Sr. Pérez displayed a map of the area's separate irrigation districts. He reported that that some districts were able to restore services within 30 to 60 days, but there was already extensive damage to important crops.

Sr. Pérez displayed slides illustrating flooding, disruption to transportation systems, failure of ditches, diversion and backflow in other waterways resulting in a contaminated water supply. He discussed damage to the land itself from mud geysers, loss of topography due to vertical displacement, higher water tables, and salinity. He noted the wheat crop nearing maturity was damaged, as was a recently planted cotton crop.

Sr. Pérez reviewed the recovery and reconstruction actions taken by the Mexican federal and state governments. He said efforts are underway to repair and rebuild the water infrastructure, reconstruct parcels of productive farmland, gain public health support, and provide support for economic development. He stated that Mexico's national water program had insurance in place protecting all irrigation canals in the area, and this money has allowed the region to begin rebuilding. Sr. Pérez discussed efforts to reconstruct land units and parcels by regrading and leveling the land, and then decontaminate water supplies. He advised that flooding has created public health problems as the populations of mosquitoes and other insects have increased.

Sr. Pérez talked about government efforts to provide temporary employment for displaced workers, temporary arrangements to obtain irrigation rights, and programs to recover arable land.

Dr. Emir Marcari, California State University at Sacramento, asked about the impact of more irrigation on contamination and salinity issues. Sr. Pérez explained that some of the land affected by mud geysers will not be replanted, but the focus will be on recovering arable land by applying deeper subsoils, cleaning agents, and soil improvements to reduce salinity below a depth of 30 centimeters. He said the land also needs proper drainage, and the depth of the water table is an important factor in analyzing the condition of each parcel.

Dr. Ken Hudnut, U. S. Geological Survey, observed that the pattern of damage appears to match the shape of the irrigation district boundaries, and he asked how those units were defined.

Sr. Pérez responded that the damage pattern relates to the proximity to the epicenter. He said farmlands were studied immediately after the earthquake, and the most damage appears to have been concentrated in the valley between the epicenter and the bordering mountain range.

Mr. McCarthy introduced Señor Carlos Ramón Oroszco Riezgo and invited him to comment. Sr. Riezgo indicated that he had recently assumed his present position but was eager to learn more about the earthquake's impacts. He reported that he had visited the Mexicali Valley to see the earthquake damage firsthand.

III. CALIFORNIA'S RESPONSE -REVIEW OF CALIFORNIA CURRENT RECOVERY POLICIES

Secretary Matthew Bettenhausen, California Emergency Management Agency (Cal EMA), commented that California works closely with her neighbors because earthquakes and other disasters do not recognize borders. He noted that providing mutual aid to Mexico has been one of Governor Schwarzenegger's top priorities since the earthquake. He indicated that there were significant earthquake impacts in California as well, including damage to canals and water systems near Calexico. Secretary Bettenhausen advised that Cal EMA provided assistance to many people in Mexico and California, and that commitment will continue.

Secretary Bettenhausen observed that California's water supply depends on the Delta, a fragile and vulnerable system that could be impacted by a major earthquake. He noted the state's 2012 ballot will include a bond measure to improve the Delta levees and water system. He added that agriculture is California's number one industry, producing over 400 crops and \$35 billion a year.

Mr. David Pegos, California Department of Food and Agriculture, urged state agencies to learn more about salinity issues. He cautioned that tilting marshland similar to that occurring in Mexico would be devastating to huge portions of California. Secretary Bettenhausen expressed interest in applying lessons from the April 4 earthquake to California.

Dr. Ken Hudnut, U.S. Geological Survey, reported that he met with counterparts in Ensenada to study drainage in the earthquake zone in more detail, and he presented slides illustrating some of his finding. He showed an intensity map with an oval pattern aligning along the fault line in the epicentral area. He stated that he and his colleagues participated in helicopter reconnaissance and rupture mapping in the days following the earthquake. He noted that JPL compared satellite images of the area before and after the earthquake to identify particular portions subject to liquefaction. Dr. Hudnut said a similar pattern was observed in Imperial Valley north of the California-Mexico border. Liquefaction occurred there in areas along old river channels and delta fractures.

Dr. Hudnut stated that the April 4 earthquake in Mexico has serious implications for California agriculture. He said the Coachella Valley earthquake simulation for this year's statewide ShakeOut event could have produced considerable damage of the same type. He noted that damage is estimated at \$91 million in Imperial Valley and about \$430 million south of the border.

Sr. Riezgo observed that underground drainage has been used successfully to mitigate liquefaction damage in some areas. Dr. Hudnut agreed, and said about 90 percent of the Imperial Valley has subsurface drainage, and there was probably less damage as a result. He advised that most damage was seen in areas with shallow water tables, and he noted that Dr. Charles Burt would be talking about this in more detail later. Dr. Hudnut noted that California is also susceptible to liquefaction, but having a lower water table is clearly important.

Commissioner Elizabeth Mathieson, Seismic Safety Commission, presented slides showing liquefaction and lateral spreading she and Ms. Heidi Stenner, Exponent, observed when they visited the area as apart of a geologic reconnaissance team about 10 days after the earthquake. Commissioner Mathieson displayed an intensity map. She reported seeing physical evidence of faulting and elevation changes, secondary ground failures, and damage to irrigation canals. She showed slides of slumping, lateral spreading, landslides, ground settlement, sand boils, sand sheets, fissuring, and contaminated and saline water. She said she learned that the area had an earthquake plan, but this damage was more severe than anticipated.

Mr. McCarthy asked what mitigation measures the reconnaissance teams would suggest. Addressing the question raised earlier about drainage tiles, Commissioner Mathieson cautioned that land can still be severely damaged is there is water within 50 feet of the surface. She cited examples of liquefaction damage in past earthquakes in 1940 and 1979, as well as some of the 2010 damage. Commissioner Mathieson pointed out that the intensity of shaking here led to the uplift of saline water, which then contaminated the water supply.

Mr. Tim McCrink, California Geological Survey, reported that he and Ms. Pridmore looked at liquefaction effects in Imperial Valley and saw more severe liquefaction damage in areas where there were no tile drains, even in places with lower groundwater levels.

Sr. Pérez stated that Mexico was fortunate that its National Water Commission had purchased insurance for the entire hydraulic network. He added that officials still were not expecting an earthquake of this magnitude for the agricultural sector.

Sr. Riezgo noted that Mexico is working to address soil settlement, especially in geothermal zones. He indicated that 80 percent of the water used along Mexico's settled coast comes from the Colorado River, and the area has about a three-month water supply stored in two reservoirs. He said it took about one week to restore water service in some affected areas. He noted the issue of urban versus agricultural water service needs to be addressed.

Dr. Charles Burt, California Polytechnic State University, discussed his studies of irrigation-related damage in California and Mexico. He explained that the soil composition in the affected area was generally a heavy clay layer on top with sand underneath. He said the well pumps operating near the California-Mexico border had few problems, but the water table is lower there.

Dr. Burt noted that drainage conditions in the Imperial Valley are different than they are in the Mexicali Valley farther south. Most drainage canals are very deep and lined with tile, but liquefaction can cause soil to shift and salts to move toward the surface. Dr. Burt indicated that

California has a high water table and salty groundwater from Mendota to Patterson, primarily the west side of the San Joaquin River, and most of the Sacramento River Valley. He added that irrigation damage to California crops would be more expensive because the crops tend to be more expensive and less tolerant. Dr. Burt stated that most of California's irrigation is pressurized, and the investment in equipment and infrastructure has been greater than in Mexico.

Dr. Burt questioned whether Mexico had any emergency plan to deal with the earthquake's impacts on a federal, state, or irrigation district basis. He expressed his opinion that federal government agencies were unable to act, but state agencies and irrigation districts responded quickly and fixed their systems as quickly as possible. He cautioned that a similar earthquake in California's agricultural area could be as devastating as an event like Hurricane Katrina. He expressed concern about having to wait a long time to access insurance money and who will be making the decisions about how the money will be spent.

IV. NEXT STEPS

Mr. McCarthy suggested thinking about next steps and ways to further California-Mexico collaboration on the issue of mitigating earthquake impacts on agriculture.

Commissioner Mathieson asked what assistance California can provide in helping Mexico obtain funds from the International Monetary Fund (IMF) or other sources.

Sr. Pérez commented that it was fortunate Mexico had insurance in place so resources were already earmarked for repairs and reconstruction. He acknowledged there was some delay as international adjusters had to visit the area, determine coverage, and decide how funds could be spent, but things moved more efficiently after about a month and a half when the state intervened.

Sr. Pérez stated that Mexico would welcome assistance with obtaining resources and funds. He advocated a new study to identify the best places for irrigation infrastructure so rebuilding can take place efficiently. He noted that scientists first need to determine if rebuilding is feasible then look at tile drainage and other improvements. He expressed his thanks for whatever technical support, knowledge, and expertise others can bring to define the best approaches. Sr. Pérez observed that the earthquake caused much more extensive damage than government officials had realized.

Ms. Stenner asked Sr. Pérez what advice he would give to California. Sr. Pérez advocated being aware of seismic risks and purchasing insurance.

Dr. Burt expressed his opinion that covering drainage canals could also help mitigate damage.

Dr. Frost observed that Mexico learned many important lessons about earthquake impacts on agriculture, and he encouraged scientists to share those insights. He suggested developing an international research and teaching center to establish global standards for earthquake response. He noted that a center of excellence would be a source of advice to many countries, including Turkey and other places with high seismic risk. He recommended using modern communication

technology like Facebook and YouTube videos to provide help, advice, and expertise in this area. Dr. Frost added that perhaps California and Mexico could work as partners to seek funding for this kind of project.

Dr. Frost stated that he was aware of Mexico's plans to construct a new port south of Ensenada to accommodate container ships delivering goods to be transported to the U.S. through El Paso. He proposed that Mexico consider building a major railway system through the Mexicali Valley, and he recommended partnering with China. He pointed out that this trade link would allow Mexico to export more food and raw materials to China, an added benefit

Sr. Riezgo commented that he thought a railroad through the Mexicali Valley was a great idea.. He expressed Mexico's eagerness to share its ideas and knowledge with others, and noted that this kind of exchange can be very valuable. He remarked that Mexico has a long way to go to make a complete recovery, and there are still many unanswered questions about the best approach to rebuilding. He added that Mexico may not have all the answers yet, but Mexico can advise others about what not to do.

Mr. Robert Anderson, Engineering Geologist, Seismic Safety Commission, thanked summit meeting participants for sharing their insights and ideas. He observed that irrigation and agricultural impacts of earthquakes are problems that have not been addressed anywhere in the world, and he encouraged Mexico to take a leadership role. He noted that earthquake risks are more serious than many people realize, and he mentioned seeing evidence of sand boils near Memphis, Tennessee, caused by earthquakes two centuries ago.

Dr. Frost said he was aware of an innovative project involving use of flexible pipe and fittings in a Tijuana prison. He encouraged Mexico to consider PEX piping for agricultural installations, and noted that Baja is the leader in this field now.

Dr. Burt indicated it costs about \$1 million per mile to line irrigation canals in CA. He recommended calculating the comparative costs of liners and covers as an alternative.

Mr. McCarthy thanked participants for their ideas. He said the Seismic Safety Commission staff will develop written descriptions for some potential new programs.

V. ADJOURNMENT

Mr. McCarthy thanked Legislative Manager Dave King for organizing the event,

There being no further business, the meeting was adjourned at 12:10 p.m.